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THE JOURNAL OF PHILOSOPHY

POINT, LINE, AND SURFACE, AS SETS OF SOLIDS [1]

THE following pages contain a series of definitions of geometrical concepts, based upon the assumed entity "solid" and the assumed relation "can connect." The precise meaning to be attached to these fundamental terms could only be made clear by a set of geometrical postulates in which they were involved; but no such set will be provided. In explanation I would say that the object in view is not the construction of a geometry, but the bringing to light of a certain limited order of relationships. It is the possibility of a geometry, rather than the geometry itself that is to be exhibited.

The formal explanation of the assumed terms being omitted, it is necessary to give an informal explanation of them. The "solid," then, may be said to be *the space occupied by a physical solid*. This, of course, is no definition—the definition of a term assumed as fundamental is in any case out of the question—but a suggestion to the reader as to what the writer is thinking about. In the same way it may be said that the assumed solids are of all possible shapes, but that no acquaintance with any particular shape is to be taken for granted. Professor Huntington's remarkable system of geometry, in which the *sphere* is assumed as an indefinable, will sufficiently illustrate what the system here suggested is not.

The statement, that the "solids" may be of all possible shapes, is to be understood as subject to this limitation: the shape must in each case be one which a single physical solid can be conceived to have. The limitation is not absolutely necessary for our purposes. With a little modification the series of definitions would stand, even if we admitted the possibility that a particular "solid" might consist of a number of wholly disconnected parts; and without change in the definitions we might admit solids consisting of parts that are in contact only at points or along lines,—like a double cone whose parts are connected only at the vertex, or a combination of two cubes that have a common edge. But no real increase in generality would be

[1] This article may be regarded as an appendix to the account of the *Nature of Space*, published in recent numbers of this JOURNAL.

gained in this way; and the interests of simplicity would seem to recommend the limitation.

We shall have no occasion to make any distinction between a possible and an actual solid; every possible solid will be treated as actual. Consequently we shall meet with all manner of intersection of solids. They will pass into and through one another, as physical solids do not. It is true that parts of one and the same physical solid may be conceived as being each a physical solid; and these parts may interpenetrate to our hearts' content. But in the case of the solids with which we shall have to deal, we shall suppose that no matter which two of them be considered, there is a third that intersects them both, or even includes them both as parts.

With respect to their magnitude, it is to be said that all the solids that we shall assume are finite, and that none are of zero magnitude. We shall have no occasion either to affirm or to deny the existence of infinite solids. We shall assume that there are no zero solids. The contrary assumption might be made. But it would call for some changes in the definitions; though these would amount to a less profound modification of the system than might easily be supposed.

The solids which we are to consider are not endowed with motion. They are to be conceived as eternal beings. Our "constructions" will be literally no constructions: we shall but turn our attention to what was already there. Nevertheless, the relations that we shall study, and in particular the fundamental relation "can connect," could scarcely have been suggested but by the behavior of movable physical solids. More explicitly, if the physical solids A and B are at rest (relatively to the field of observation), and the solid C is such that we can manipulate it with a fair degree of freedom, to say that C can connect A and B would be understood to mean that we could, if we wished, put C in simultaneous contact with A and B; and it is, so to speak, the shadow of this physical relation that we shall assume for our geometrical solids.

Yet there are some noteworthy modifications of the relation, due especially to the free interpenetration of our solids. This will be made clear if, provisionally, we define the geometrical "can connect" in other terms. "A can connect B and C" is to be understood as meaning that there exists at least one solid X, such that X is equal in all its parts to A, and such that X has at least one point in common with B and at least one point in common with C. In other words, the "connecting" may be done *either by overlapping or by external contact.*

Accordingly, the physical relation "can connect" may easily fail to obtain, where in the analogous case the geometrical relation would

obtain. Suppose the physical solid B to be hollow; and suppose that C lies deep inside B. Then no physical solid A, that lies beside B, can possibly be made to connect B and C. But in the analogous case for geometrical solids, if A is only big enough, there is no trouble about its being "able" to do the connecting. Suppose further that the hollow physical solid B not only has C inside it but wraps it tightly around, so that they are in contact over the whole surface of C. Then there will, in general, be *no* physical solid that can be brought into simultaneous contact with them. In the analogous case for geometrical solids, *any* solid "could" do the connecting.

In the course of the development, a modified form of Professor Whitehead's method of "extensive abstraction" is introduced. The modification consists in the use, not of the relation of "extending-over" (the relation of whole to part), but of the relation of "containing," in the sense of not simply including as a part but completely enveloping. Through this modification the method is greatly simplified and strengthened. It is, I believe, impossible by means of the method in its original form to give a definition of the point in terms of the solid.[2]

If containing is assumed as a primitive relation, extending-over can easily be defined. Thus, to speak of solids, "A extends over B" can be explained as meaning: "There is a solid which is contained by A but not by B, and there is no solid that is contained by B but not by A." Hence the defining-power of the modified method is not inferior to that of the original. It is, in fact, much greater.

However, in the present treatment neither containing nor extending-over is assumed as primitive, but both are defined in terms of the relation "can connect." This mode of approach has the further advantage, that the conceptions of *length* and *collinearity* can be defined without the introduction of any additional indefinable. A complete conceptual foundation for geometry is thus provided.

With the definitions two postulates are included, which are of special importance for understanding the real significance of the definitions.

INDEFINABLES

Solid.—(Solids are to be denoted by capital letters. Different

[2] *Cf.* A. N. Whitehead, *The Concept of Nature*, p. 86f.; also a note by the present writer in the *Philosophical Review* for March, 1921. The definition of the point which I once offered as an illustration of Professor Whitehead's method (in a review of his "Principles of Natural Knowledge" in the *Philosophical Review* for May, 1920) involves both an error of interpretation and a serious blunder.

letters need not denote distinct solids. Classes of solids will, till further notice, be denoted by small letters.)

Can connect.

Postulates

Postulate of Identity: If A and B are such that there are no W and X, such that W can connect A and X but can not connect B and X; and, similarly, there are no Y and Z, such that Y can connect B and Z but can not connect A and Z; A and B are identical.

In other words, if A and B are alike in their capacity of being connected with other solids, they are identical.

Postulate of Measurement: If A and B are such that W and X exist, such that A can connect W and X but B can not, then there are no Y and Z such that B can connect Y and Z, but A can not.

When we have defined the expression "longer than" we may restate this principle in the form: If A is longer than B, B is not longer than A.

DEFINITIONS

I. If A and B are such that X exists, such that X can not connect A and B, A and B are said to be *disconnected.*

II. If A and B are not disconnected, they are said to be *connected.*

III. If A and B are such that every solid connected with A is connected with B, but not every solid connected with B is connected with A, A is said to be a *part* of B.[3]

IV. If A and B are not identical and have a common part, they are said to *intersect.*[4]

V. If A and B have no common part they are said to be *separated.*

The reader should note carefully the distinction between the terms "disconnected" and "separated." Any two solids that are disconnected are separated; but the converse is not true.

VI. If A and B are separated, but not disconnected, they are said to be *in contact.*

VII. If A is a part of B, and if every solid that is in contact with A intersects B, A is said to be *contained* in B.

We are now ready to proceed to the definition of the point by the method of extensive abstraction.

[3] It is worthy of remark that the relation of whole and part can also be defined directly in terms of the relation can-connect. Thus we may say: If A and B are not identical, and if there are no X and Y such that X can connect A and Y and can not connect B and Y, A is said to be a part of B.

[4] Here, and as often as possible below, I follow Professor Whitehead's terminology.

VIII. If a set of solids is such that

(1) of every two members of the set, one is contained in the other;

(2) there is no solid contained by every member of the set;

it is called an *abstractive set.*[5]

The first specification shows that the abstractive set is like a *nest of boxes,* one within another; except, to be sure, that whereas each smaller box lies within the hollow interior of the larger box, each smaller solid of the abstractive set is a part of the larger solid. The second specification shows that the abstractive set is an unending sequence of solids. There can not be a smallest solid of the set; because, if there were, any solid which it contained would be contained by all the solids of the set.

In ordinary terms we would say that the abstractive set must converge upon a point, a line or curve, a surface, or some combination of lines and surfaces. We have not assumed the existence of such entities as points, lines, and surfaces, and so can not use them for the definition or classification of abstractive sets. It will be shown how abstractive sets may be used for the definition of points, lines, and surfaces.

As an example of an abstractive set, the reader may consider a set of concentric spheres, growing less and less *ad infinitum*—never reaching nothingness but approaching it as a limit. Or, in place of the spheres, we might have, say, concentric cubes. Again, we might have a set of co-axial cylinders, diminishing in such a way that the radius approaches zero, while the altitude approaches a limit which is not zero. Yet again, we might have a set of rectangular parallelopipeds, diminishing so that one dimension approaches zero, while each of the other dimensions approaches a limit which is not zero.

IX. If m is an abstractive set, the class of the solids that contain members of m is called an *abstractive element,* or simply an *element.*

X. If two abstractive elements are not identical, and one logically includes the other, the former is said to *lie in* the latter.

Note that different abstractive sets may serve to define the same abstractive element. To return to the above examples, if the set of the concentric cubes and the set of concentric spheres have the same center, every solid that contains one of the cubes will contain one of the spheres; and conversely, every solid that contains a sphere will

[5] This definition departs from Professor Whitehead's by substituting the relation of containing for that of including as a part. There is the further difference, that the sets with which he deals are not sets of solids but sets of four-dimensional *events.*

contain a cube. Thus the set of cubes and the set of spheres determine the same element.

On the other hand, consider the case of a set of co-axial cylinders, such as was suggested above, and a set of concentric spheres whose center lies in the midst of the common axis of the cylinders. Every solid that contains one of the cylinders will contain one of the spheres; but there will be solids that contain some of the smaller spheres but do not contain any of the cylinders. Hence the class of the solids that contain members of the set of spheres logically includes the class of the solids that contain members of the set of cylinders. It is in such a case that, in accordance with Definition *X*, we say that the one class lies in the other.

XI. A *point* is an abstractive element in which no other abstractive element lies.

It will be observed that the point is here defined as the class of those solids which would ordinarily be described as containing the point—that is to say, the point would lie in each solid, but not in its surface. The formal properties of the point as here defined are easily seen to be identical with those of the point conceived as an irreducible individual.

The following definitions are much less important and increase rapidly in difficulty. The reader who so desires may pass at once to the concluding remarks.

Hereafter abstractive elements, as well as solids, will be denoted by capital letters.

XII. If the solid *A* is a member of the point *P*, *P* is said to be *contained* in *A*.

This use of "contained" will be found to be closely analogous to its use as denoting a relation between two solids. Thus no serious ambiguity is involved.

XIII. If every solid that contains the solid *A* contains the point *P*, *P* is said to *lie* in *A*.

This definition may be extended so as to embrace the analogous relation between a solid and any abstractive element. The present definition may also be stated: If the class of solids that contain the solid *A* is logically included in the point *P*, *P* is said to lie in *A*.[6]

It will be observed that the relation between solid and point (or other element), which is here defined, is closely analogous to the relation "to lie in" subsisting between two abstractive elements (Definition *X*).

[6] An alternative definition that is worthy of notice is this: If no solid that contains the point *P* is disconnected with the solid *A*, *P* is said to lie in *A*.

XIV. If the point P is a member of the set of points m, and there is a solid that contains P and contains no other member of m, P is said to be *isolated* in m.

Note that if m has but one member, that is an isolated member.

XV. If a point P is not a member of the set of points m, but every solid that contains P contains members of m, P is said to be *adjacent* to m.

Consider, for example, the set of the points that lie in a straight line PQ, between the extremities P and Q. Both P and Q are adjacent to this set.

XVI. If a set of points m is included in a set n, and there is a member of m which is not adjacent to the set of those points which are members of n but not of m, m is said to be *divergent* in n.

Thus suppose n is the set which includes the points within a circle, those in its circumference, and those in a line tangent to the circle; and suppose m is the set of the points in the tangent. Then, except the point of tangency, no member of m is adjacent to the set of the points that are in n but not in m; and accordingly m is divergent in n.

XVII. If a set of points includes no isolated points, and has no points adjacent to it, it is said to be *perfect*.

This definition is substantially in accord with Cantor's metrical definition of the term. What it really amounts to depends, of course, on the existential postulates that determine the universe of solids. It should be observed that a perfect set may consist of several parts that are in no wise connected with one another.

XVIII. If a perfect set is such that every perfect set which it includes is divergent in it, it is said to be a *one-dimensional* set.

XIX. If a perfect set is such that no one-dimensional set which it includes is divergent in it, it is said to be a *doubly perfect* set.

XX. If a doubly perfect set is such that every doubly perfect set which it includes is divergent in it, it is said to be a *two-dimensional* set.

XXI. If a doubly perfect set is such that no two-dimensional set which it includes is divergent in it, it is said to be a *trebly perfect* set.

XXII. If a trebly perfect set is such that every trebly perfect set which it includes is divergent in it, it is said to be a *three-dimensional* set.[7]

[7] While the order of Definitions XVII–XXII is fixed, the statement of them may be conveniently consolidated as follows:

$$\text{If a set of points} \begin{cases} \text{has no point adjacent to it} \\ \text{is perfect} \\ \text{is doubly perfect} \end{cases} \text{and includes no} \begin{cases} \text{isolated} \\ \text{divergent} \\ \text{divergent} \end{cases}$$

It should be observed that if the set of all points is three-dimensional, every trebly perfect set is three-dimensional.

XXIII. If a { perfect / doubly perfect / trebly perfect } set of points is such that it includes no two { perfect / doubly perfect / trebly perfect } sets that exhaust its members and themselves include no common { point, / perfect set, / doubly perfect set, } it is said to be { *continuous.* / *doubly continuous.* / *trebly continuous.* }

XXIV. If a { one-dimensional / two-dimensional / three-dimensional } set of points is { continuous, / doubly continuous, / trebly continuous, } it is said to be a { *one-dimensionally continuous* / *two-dimensionally continuous* / *three-dimensionally continuous* } set.

The two following definitions are somewhat aside from the purpose of the present discussion; but they are given here because of their utility in serving to define various types of lines and surfaces.

XXV. If two sets of points have no common member, and are such that there is no continuous set that includes members of both but no other points, the two sets are said to be *disjoined.*

XXVI. If a set of points p (which may consist of one point P) and a continuous set m have a common member or members, and the remaining members of m consist of two disjoined sets, p is said to *divide* m; and if, further, no set included in p (not identical with it) divides m, p is said to divide m *economically.*

One-dimensionally continuous sets may now be classified according as they are divided (i) by any one of their points; (ii) by any one of their points except one; (iii) by any except two; (iv) by any two, but by no one; *etc.* Similarly, various types of two-dimensional sets may be characterized by the number and type of the one-dimensional sets that divide them.

It has become common in recent years to regard the line and the surface—and, indeed, the solid also—as sets of points. From

{ point, / one-dimensional set, / two-dimensional set, } it it said to be { *perfect.* / *doubly perfect.* / *trebly perfect.* }

If a set of points is { perfect, / doubly perfect, / trebly perfect, } and every { perfect / doubly perfect set / trebly perfect } which it includes is divergent in it, it is said to be a { *one-dimensional* / *two-dimensional* / *three-dimensional* } set.

that standpoint, the definition of the one-dimensionally continuous set may be taken as the definition of the line; and the definition of the two-dimensionally continuous set (or, if it be preferred, the continuous two-dimensional set) may be taken as that of the surface. Professor Whitehead, however, has shown that the line and the surface may be regarded as abstractive elements. The following definitions apply to them in that capacity.

XXVII. If an abstractive element is such that the set of the points which lie in it is one-dimensional, it is called a *line*.

XXVIII. If an abstractive element is such that the set of the points which lie in it is two-dimensional, it is called a *surface*; and if, further, the set is doubly continuous, the surface is said to be *unitary*.[8]

Does the figure *8* bound one surface or two? According to this definition, it bounds one surface, but that is not a unitary surface.

We now proceed to some metrical conceptions. The development follows closely the lines laid down in the second article of this series (pp. 428–9). In some cases no change in the definitions there given is called for; in other cases, only the omission of all reference to "chains" of solids. The reader is, therefore, hereby referred to the earlier discussion. In the case of the definition of the sum of two lengths, however, a more serious revision is necessary.

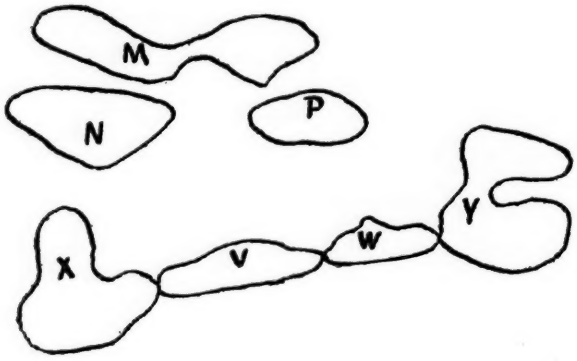
XXIX (*a*) *Farther apart.*	(*b*) *Longer.*
XXX (*a*) *Just as far apart.*	(*b*) *Just as long.*
XXXI (*a*) *Distance.*	(*b*) *Length.*
XXXII (*a*) *Greater* (of distances).	(*b*) *Greater* (of lengths).
XXXIII (*a*) *Equal* (distance to length).	(*b*) *Equal* (length to distance).
XXXIV (*a*) *Greater* (distance compared to length).	(*b*) *Greater* (length compared to distance).

XXXV. If A and B are such that there is no solid X such that X can not connect A and B, the distance between A and B is said to be *zero*.

[8] These definitions are somewhat wider than those which Professor Whitehead has given, and I believe are better in accord with the tradition and the needs of the science. For example, according to Professor Whitehead, there is no complete spherical surface except in the sense of a set of points. The reason is that Professor Whitehead is hampered by limitations upon the possible shape of the four-dimensional entities—events—which his system uses as its basis. (*Cf. The Concept of Nature*, pp. 101ff.)

In many cases *hollow* solids are required for the abstractive sets upon which surfaces are founded. That is the case with the spherical surface, for example. Similarly, for the abstractive sets upon which lines are based, *ring-shaped* solids are often needed. But such cases offer no peculiar difficulty.

This is the relation that was earlier expressed by saying that A and B were *connected.* We might define a zero-length as the length of a solid which can not connect any solids except those the distance between which is zero. But we are not to assume the existence of such solids. If we did, we should very naturally reserve for them the name of "points."



XXXVI. (*b*) If M, N, and P are such that X and Y exist, such that the distance between X and Y is equal to the length of M, and such that V and W exist such that V is just as long as N, and W is just as long as P; and if the distances between X and V, V and W, and W and Y are zero; and if no solid M' exists, such that M' is longer than M and stands in this same relation to N and P; the length of M is said to be the *sum* of the lengths of N and P.

XXXVI. (*a*) *Sum* (of two distances).

In the same way, we may define the sum of any number of lengths or of distances, or of both lengths and distances. The sum of a length and a distance may, by convention, be regarded as a distance.[9]

[9] Attention may be called to the fact that these metrical definitions are entirely independent of those which precede them in the present series, for they go back directly to the indefinable relation, "can connect." Accordingly, it is possible, and for some purposes it may be advantageous, to substitute metrical definitions of the relations of whole and part, containing, *etc.*, and these deserve a passing mention.

(In place of Definitions II and I.) If the distance between A and B is zero, they are said to be *connected;* otherwise they are said to be *disconnected.*

(In place of Definition III.) If A and B are such that X does not exist such that the distance between B and X is greater than the distance between A and X; and if Y does exist such that the distance between A and Y is greater than the distance between B and Y; A is said to be a *part* of B.

In other words, if no solid is farther from B than from A, and there is a solid that is farther from A than from B, A is a part of B.

The distance between a point and a solid, and the distance between two points require special treatment.

XXXVII. If the point A and the solids B and C are such that C can connect B and any member of A, but for all values of C', where C' is a solid and C is longer than C', there is a member of A which C' can not connect with B; the *distance* between A and B is said to be the distance which is equal to the length of C.

XXXVIII. If the points A and B and the solid C are such that C can connect any member of A and any member of B; but for all values of C', where C' is a solid and C is longer than C', there is a member of A and a member of B which C' can not connect; the *distance* between A and B is said to be the distance that is equal to the length of C.

The definition of the between-relation and of collinearity is now effected as in the first article of this series.

XXXIX. If the points A, B, and C are distinct, and are such that the distance between A and C is the sum of the distances between A and B and between B and C; B is said to be *between* A and C.

XL. If either the point A is between the points B and C, or B is between A and C, or C is between A and B, the three points are said to be *collinear*.

The straight line, as an abstractive element, may now be defined.

XLI. A *straight* line is a line such that every three points that lie in it are collinear.

Are there straight lines of infinite length? That depends upon the question whether there are solids of infinite length; which in a Euclidean geometry is as much as to ask whether there are solids that can connect any two solids whatsoever. It is of very slight importance whether an affirmative or a negative answer is assumed.

A matter of far greater importance is the "fixing" of the straight line by any two of its points. This amounts to the proposition, that if the points A, B, and C are collinear, and the points A, B, and D are collinear, then A, C, and D are collinear. In the choice of postulates upon which a system of geometry is to be founded, this is one of the essential aims to be held in view.

(In place of Definition VII.) If A and B are such that no X exists such that X is separated from A and such that the distance between A and X is not greater than the distance between B and X; A is said to *contain* B.

The definition of abstractive sets and elements may be left unchanged. The following suggests itself as the appropriate metrical definition of the point:

(In place of Definition XI.) If an abstractive element A is such that for every solid X there is a member of A that is not longer than X, A is called a *point*.

What, now, is the philosophical significance of this, or an equivalent, series of definitions. And, in particular, what significance has the identification of the point with a class of solids? I believe it to be considerable, but that it is open to serious misinterpretation.

Recent theories with respect to the relation between geometry and mechanics have given rise to a demand for the definition of the point in definitely experiential terms. For points are not primary data of experience—if there are such data. They are never perceived by us, and their existence is never made evident by any distinguishable effect, however delicate, of their presence. We can not infer their existence from the perturbation of the orbit either of a planet or of an electron. They are conceptual constructs; and it is a problem for analytical science to exhibit the mode of their construction.

On its face, the method of extensive abstraction is an application of "Occam's razor." Instead of the point, which we do not perceive, we are given a class of solids such as we do perceive; and thus entities are not multiplied unnecessarily. But the point, as we find it in geometrical tradition, is not an altogether distinct kind of entity. It is a solid, remarkable in only one fundamental respect, namely, that its length is zero. To be sure, no solids of zero length are perceived by us; but we could not perceive them if they existed. And, furthermore, although we perceive solids, we perceive no abstractive sets of solids; and there is no indirect empirical assurance that such sets exist—only suggestive evidence that entitles us to assume that they exist. In accepting the abstractive set, we are as veritably going beyond experience as in accepting the solid of zero-length.

It may be replied that the assumption of the abstractive set is in any case more economical than that of the zero-solid, because if there are zero-solids there are abstractive sets, while there may be abstractive sets without zero-solids. But this statement, I believe, is only superficially correct. Just because the zero-solid is an entity that lies beyond the limits of any possible direct or indirect perception, the assumption of its existence means less than the formal proposition indicates. A real point (as I have elsewhere had occasion to urge) means no more or less to us than a possible point. Hence the method of extensive abstraction has not so much eliminated the zero-solid as it has analyzed it. The method has made us realize more distinctly than ever before what the assumption of the zero-solid logically amounts to.

Thus, if I am right, the method of extensive abstraction simply gives us one more illustration of Galileo's great principle: that the

laws of physics—among which the laws of geometry may here be included—are descriptions of ideally simple cases, which no experience presents to us, but which the objects of our experience do with various degrees of closeness approach. The formal elimination of the limit itself, in the case of geometry, and the statement of the laws in terms of an infinitely continued approximation, only brings out with a new clearness what their real nature has always been. I say it does only this; but is not that sufficient?

Meanwhile we ought not to forget that the geometrical solid itself is not given in experience.[10] It, too, is the product of an idealization —if not individually, then as a member of its class. If we say that the physical solid is a geometrical solid and more, we forget that no perception assures us that it has the most elementary properties of a geometrical solid; for those properties are relative to the existence of other geometrical solids which are *not* physical solids. As of the point, so we must say of the geometrical solid itself: the distinction between the possible and the actual has no place. To define the point as a class of solids is *not* to find a place for it in the real world. That can only be done by analyzing those properties of the physical solid upon which geometry, as an empirical science, is founded.

If the point can be conceived as a set of solids, so the solid—the geometrical solid—can be conceived as a set of points. So far as the formal logical relations are concerned, there is not a particle of advantage in the matter, either on the one side or on the other. Historically, as I have elsewhere urged, the conception of space had to wait upon the development of the point. Psychologically, the point has this advantage over the geometrical solid: that its very smallness accounts sufficiently for its absolute imperceptibility, and it is thus able to serve as a middle term for the thought-transition from the physical to the geometrical solid. Practically, it is the point that gives space its excuse for being. A space without points would be little more than an obstacle between us and the physical world.

Every new scientific perspective is valuable; and the method of extensive abstraction has given us a new perspective of very great value indeed. But we must not let ourselves fall into the illusion that the novel order which it presents is truer, or necessarily more fundamental, than that which has long been familiar to us.

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[10] I should, of course, say the same of Professor Whitehead's "events."

DOING WITHOUT DISTRIBUTION IN FORMAL LOGIC

IN the following paragraphs I shall maintain that it is feasible to expound formal logic without making any use of the notion of a distributed term; that the exposition is, indeed, simpler and more readily understood without the doctrine of distribution than with it. Lest this should be regarded as a recantation, let me remind anyone who may have read my article on "The Distribution of the Predicate,"[1] that I expressly reserved judgment concerning the pedagogical utility of the doctrine of distribution, while defending its validity against the destructive criticism of Professor Toohey in his *Elementary Handbook of Logic. If one succeeds in mastering them,* the rules of distribution very conveniently sum up certain of the conditions of validity in conversion and the categorical syllogism. Beginners in the study of logic, however, find the notion of a distributed term exceedingly difficult, and usually apply the rules in a very mechanical fashion. If, then, some alternative tests of validity can be devised which will be easier for the learner to understand, and more nearly in accord with the way in which he naturally tries to "reason out things," the rules of distribution may wisely be laid on the shelf.

By a slight change in the customary order of exposition I have found it possible to get along very well without distribution. This change consists in discussing the hypothetical syllogism before taking up immediate inference and the categorical syllogism, both of which may then be explained in the light of the principles of hypothetical reasoning. That in a general way the categorical and the hypothetical forms of reasoning are equivalent is not, to be sure, a new idea. The traditional view has been, however, that the categorical argument is somehow the normal and natural form; that the categorical syllogism should therefore be explained first; and that the hypothetical should then be shown to be equivalent to the categorical. My suggestion is that in presenting formal logic to beginners this traditional order of exposition should be reversed.

1. *Testing the Validity of Conversion.*—Of the various forms of "immediate inference," the only one which we need to consider is conversion; for it is the only one to which the rule of distribution is applicable. In my former article I advanced the view that a term is not distributed or undistributed absolutely, but only with respect to some other term. Now, in inversion the subject of the original proposition is replaced by its contradictory. In the case of the partial inverse, accordingly, where the rule of distribution seems to

[1] This JOURNAL, Vol. XVII, pp. 519–522.

be violated, the rule is really irrelevant. "All *S* is *P*," being the original proposition, and "Some non-*S* is not *P*," the partial inverse, it is true that *P* is distributed in the inverse and undistributed in the invertend; but in the invertend it is undistributed with respect to *S*, while in the inverse it is distributed with respect to non-*S*; and from lack of distribution with respect to *S* we have no right to infer lack of distribution with respect to non-*S*. Indeed, as Mr. Hammond points out,[2] *if non-S exists* (that is to say, if the inversion of "All *S* is *P*" is possible), *P is* distributed with respect to non-*S* in the original proposition as well as in the partial inverse. If, then, we remember that distribution is a relative notion, that a given term may be distributed with respect to one term and undistributed with respect to another, it is manifest that the rule of distribution is relevant to no form of immediate inference except conversion; since in all the other forms,—obversion, contraposition, inversion,—we change one or both of the terms of the original proposition. In the case of conversion, however, the rule is pertinent. *Neither term of the converse may be distributed with respect to the other, unless in the convertend it was distributed with respect to the same term.* Professor Toohey, it must be conceded, is quite right in maintaining that the attempt to prove the validity of any given process of conversion by simply appealing to this rule would involve us in a circle. The rule of distribution as applied to conversion is not an independent proposition, but rather a corollary from the demonstration of the validity of the processes in question. Nevertheless, admitting this to be its status, it serves as a convenient summary of what is possible and what is impossible in the simple conversion of the four types of the categorical proposition, *A, E, I,* and *O*.

If, then, we are to expound conversion without using the notion of distribution, we ought to find another way of summing up these results which is at least equally convenient. This, as I have said, is afforded by the possibility of reducing our propositions to the hypothetical form.

The question is, which of our four typical propositions can be converted simply. Consider first the *E* proposition, "No *S* is *P*." Its simple converse is, "No *P* is *S*." We wish to prove that we can pass from the truth of either of these to the truth of the other. Now the hypothetical equivalent of the former is, "If x is *S*, x is not *P*," while that of the latter is, "If x is *P*, x is not *S*." And it is evident by the principle of the *modus tollens* that the truth of either of these hypothetical propositions may be inferred from that of the other. Consequently the first of the categorical propositions implies the

[2] This JOURNAL, Vol. XIX, p. 127.

second, and *vice versa*. If, however, we attempt to convert the *A* proposition simply, we should pass from, "All *S* is *P*," to "All *P* is *S*." Now these propositions are equivalent respectively to the hypotheticals, "If *x* is *S*, *x* is *P*," and, "If *x* is *P*, *x* is *S*." But these are not equivalent to each other; for the attempt to pass from the truth of one to the truth of the other involves the fallacious principle of the "affirmation of the consequent." Consequently the first of these categorical propositions does not imply the second, nor the second the first. Therefore, simple conversion is *not* valid in the case of the *A* proposition.

Granted the results just established for *E* and *A*, granted also the principle of the "square of opposition," it is easy to show whether or not *I* and *O* may be converted. Let *E'* be the simple converse of *E*, *I'* of *I*, *etc.* Then, if *I* be true, *E* is false, *E'* is false, and *I'* is true; while, if *I* be false, *E* is true, *E'* is true, and *I'* is false. In other words, from the truth of *I* we can infer the truth of *I'*, and from the falsity of *I* the falsity of *I'*. Therefore, the *I* proposition is convertible. In like manner, if *O* be true, *A* is false, *A'* may or may not be false, and *O'* may or may not be true; while, if *O* be false, *A* is true, *A'* may or may not be true, and *O'* may or may not be false. In other words, we have no right to reason confidently from the truth or the falsity of *O* to the truth or the falsity of *O'*. Therefore the *O* proposition is *not* simply convertible.

These results may be stated briefly in the formula that the simple conversion of *E* is analogous to the denial of the consequent, and that of *A* to the affirmation of the consequent in the hypothetical syllogism; while, as regards simple conversion, the case of each of the particular propositions is the same as that of its contradictory.

2. *Testing the Validity of the Categorical Syllogism.*—If distribution is a relative notion, the rules of distribution in the case of the categorical syllogism become, "Neither term of the conclusion may be distributed with respect to the other, unless in its premise it was distributed with respect to the middle term"; and, "The middle term must be distributed with respect to at least one of the other terms." These rules, as necessary (but not sufficient) conditions of validity, proceed from the relations of inclusion and exclusion upon which the categorical syllogism is founded. For the sake of brevity I employ the letters, *S*, *M*, and *P* to indicate, not only the three terms of the syllogism, but also the classes denoted respectively by those terms.

The first rule is evident, then, from the following considerations: (*a*) To prove that *S* is wholly within (or without) *P*, we must know that *M* is wholly within (or without) *P* and that *S* is wholly within

M. (*b*) To prove that *P* is wholly without *S* (or a part of *S*), we must know that *P* is wholly without *M* and that *M* includes (at least a part of) *S*.

The necessity of the condition prescribed by the second rule is, if possible, even more obvious. The rule requires, in effect, that if *M* is not distributed with respect to *P*, it must be distributed with respect to *S*. Now suppose that *M* is not distributed with respect to *P*. Then so far as our information goes, *M* may be partly within and partly without *P*. In this case, however, it is evident that the knowledge that *S* is wholly within *M* would not justify any conclusion as to the relation of *S* to *P*, since *S* might not be contained (even partly) in the part of *M* which is within *P*. On the other hand, the knowledge that *S* is wholly *without M* would justify a conclusion, other conditions being fulfilled,—for that which is without *M* must also be without the part of *P* which is included within *M*. But in this case, in the only case in which a conclusion is possible when *M* is undistributed with respect to *P*, *M* is distributed with respect to *S*.

It is clear, then, that the notion of distribution, which is irrelevant in the case of the partial inverse, is applicable not only to the converse but also to the categorical syllogism. It is, accordingly, with a certain degree of bewilderment that I read Mr. Hammond's comment that I am "quite right in pointing out that the distribution of a term is not an absolute matter," but that Professor Toohey is also "quite right in maintaining that to make a term distributed or undistributed relatively to some other term and to deny any pertinency to this distribution elsewhere is equally to take all value from distribution." To say that a rule or concept is irrelevant in one specific situation is obviously not the same as to say that it is irrelevant all along the line.

If, then, we are to expound formal logic without making any use of the notion of a distributed term, we ought to find a substitute for such of the traditional rules of the syllogism as involve this notion. This we find in the reduction of all categorical syllogisms to the hypothetical form, when they may be tested by the rules of the hypothetical syllogism. Syllogisms of the third or of the fourth figure are, of course, readily reducible by the conversion (or partial contraposition) of the minor premise to the first or the second figure. It remains to show with what ease we may then complete the reduction to the hypothetical form. Consider these moods of the first figure:

All *M* is *P*	All *M* is *P*	All *M* is *P*	All *M* is *P*
All *S* is *M*	No *S* is *M*	Some *S* is *M*	Some *S* is not *M*
All *S* is *P*	No *S* is *P*	Some *S* is *P*	Some *S* is not *P*

Let us now throw the common major premise into the hypothetical form. "All *M* is *P*," is equivalent to, "if *x* is *M*, then *x* is not *P*." Let *x* equal "any *S*." We now have:

If any *S* is *M*, then it is *P*

All *S* is *M*	No *S* is *M*	Some *S* is *M*	Some *S* is not *M*
All *S* is *P*	No *S* is *P*	Some *S* is *P*	Some *S* is not *P*

It is clear that only the first and third are valid. Next consider several moods of the first figure which have a major premise of type *E*:

No *M* is *P*	No *M* is *P*	No *M* is *P*	No *M* is *P*
All *S* is *M*	No *S* is *M*	Some *S* is *M*	Some *S* is not *M*
No *S* is *P*	No *S* is *P*	Some *S* is not *P*	Some *S* is not *P*

"No *M* is *P*," is equivalent to, "if *x* is *M*, it is not *P*." Again let *x* equal "any *S*." We now have:

If any *S* is *M*, then it is not *P*

All *S* is *M*	No *S* is *M*	Some *S* is *M*	Some *S* is not *M*
No *S* is *P*	No *S* is *P*	Some *S* is not *P*	Some *S* is not *P*

Here, again, it is clear that only the first and the third are valid.

The valid moods of the first figure are then equivalent in each case to a hypothetical syllogism in which the minor premise affirms the antecedent. In other words, the first figure of the categorical syllogism, if valid, reduces to the *modus ponens*. We shall now show that if the second figure is valid it reduces to the *modus tollens*. We shall prove this for but one mood, leaving it to the reader to prove it for the rest.

No *P* is *M* = If any *S* is *P*, it is not *M*

All *S* is *M*	All *S* is *M*
No *S* is *P*	No *S* is *P*

We notice that the minor premise disagrees with the consequent of the major. The syllogism is therefore valid,—a *modus tollens*.

No mood has been examined in which the major premise is particular. Suppose the major premise to be, "Some *M* is *P*." Thrown into hypothetical form this would give us nothing stronger than, "If *x* is *M*, then *x may* be *P*," or, "If *x* is *M*, there is a certain degree of probability that it is also *P*." But from a major premise no stronger than this, no trustworthy inference can be drawn. Accordingly, if the major premise is particular and the minor universal, the premises should be transposed; while if there is no universal premise, the syllogism is invalid. On the other hand, if there are two universal premises, and with one of them as

major the syllogism appears to be invalid, the premises should be transposed; for in a few cases the syllogism will be found valid when one of the universal propositions is chosen as major premise, although apparently invalid if the other is taken.

It may now be helpful to recapitulate the steps which have been proposed. In each case as many are to be employed as may be necessary.

1. If the major premise is particular, transpose the premises. (The transposition of the premises obviously requires the conversion or the contraposition of the conclusion.)

2. If the syllogism is of the third or the fourth figure, reduce it to the first or the second, as may be the more convenient. In some cases this can be accomplished most readily by converting (or contraposing) the minor premise; in others by transposing the premises.

3. Reduce the syllogism thus obtained to the hypothetical form.

4. Test it by applying the rule of the hypothetical syllogism.

5. If the syllogism has two universal premises, and the test indicates invalidity, transpose the premises, and repeat the test.

Not only is it possible in this way to avoid the use of the difficult notion of a distributed term, but by applying the principles of hypothetical reasoning the other rules of the categorical syllogism may be established:

1. In every valid categorical syllogism there are three terms, and only three; for otherwise there would be no term common to both premises, and in the equivalent hypothetical syllogism, the minor premise, instead of affirming the antecedent or denying the consequent of the major, would be entirely irrelevant, *i.e.*, would say nothing about the major premise at all.

2. If both premises are affirmative, the conclusion must be affirmative; for it is evident that the corresponding hypothetical syllogism, if valid, will be a *modus ponens*.

3. If both premises are negative, the syllogism is invalid. For the major premise will then be equivalent to, "If x is A, then x is not B"; and, as the minor premise is also negative, it can neither agree with the antecedent nor disagree with the consequent of the major.

4. If either premise is negative, the conclusion must be negative. Suppose it is the major premise which is negative. Then, if the equivalent hypothetical syllogism is valid, the minor premise must either agree with the antecedent of the major, in which case the conclusion must agree with the consequent; or the minor premise must disagree with the consequent, in which case the conclusion

must disagree with the antecedent. But in either case the conclusion must be negative. On the other hand, if it is the minor premise which is negative, the syllogism must be a *modus tollens*, and the conclusion will be negative.

5. If both premises are particular, the syllogism is invalid. We have already seen that in the first and second figures the major premise must be universal; and there is no way by which a syllogism with two particular premises can be reduced to an equivalent syllogism having a universal premise.

6. If either premise is particular, the conclusion must be particular. For, when the syllogism is reduced to the first or the second figure, the particular premise will be the minor premise, and its subject will be the minor term and consequently also the subject of the conclusion.

With a little practice the student will learn to tell by inspection, without completing the reduction to the hypothetical form, whether a given syllogism is valid or invalid. In general, if there is a universal premise of which the middle term is the subject, and the other premise is *affirmative*, the syllogism is, or may readily be reduced to, a valid syllogism of the first figure. If, however, after the syllogism has been reduced to the first figure, the minor premise is *negative*, the syllogism is *invalid*. For it is clear that an affirmative minor premise in the first figure will affirm the antecedent, while a negative minor premise will deny the antecedent when the major premise is expressed in hypothetical form.

Likewise, if there is a universal premise of which the middle term is the predicate, and the premises *differ in quality*, the syllogism is, or may readily be reduced to, a valid syllogism of the second figure. If, however, after the syllogism has been reduced to the second figure, the premises do not differ in quality, the syllogism is *invalid*. For if the premises differ in quality it is clear that when the major premise is expressed in hypothetical form the minor premise will deny the consequent; while if the premises are of the same quality, it will affirm the consequent.

My position is, then, that the doctrine of distribution is valid, but that for pedagogical reasons it may well be dispensed with. By adopting the order of exposition outlined in the preceding paragraphs, the "deductive" part of logic is given a unity and interconnectedness such as is not otherwise attainable. An incidental advantage—which has already been hinted at—is that the forms of thinking employed in the exposition are more nearly akin to those of other sciences and of everyday life. The rules of distribution are not likely to be used outside the class-room devoted to the study

of formal logic. On the other hand, the hypothetical forms of reasoning are employed every day, everywhere. They are "identical elements" in many diverse intellectual operations.

This method of exposition is, of course, not wholly new. Mr. L. J. Russell, for example, approximates it very closely in his *Logic from the Standpoint of Education.* But even he—whether because of deference to tradition or for some other reason—presents the hypothetical syllogism *after* the categorical. And most of the text-books proceed on the assumption that the categorical type of argument is somehow the genuine, true and fundamental type, of which the hypothetical is but a more or less unwieldy derivative; as witness the desperate efforts of Jevons and others to reduce all hypothetical propositions to the categorical form. Is it not simpler to reverse the traditional order, to treat the hypothetical as the generic type, of which the categorical is a specific modification? There may be some recondite objection to this procedure; but until it is pointed out, the simpler organization of the subject-matter appears to be preferable.

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BOOK REVIEWS

Human Nature and Conduct: An Introduction to Social Psychology. John Dewey. Henry Holt & Co. 1922. Pp. 336.

If pragmatism is not the sanctification of commercialism, and of course no one soberly supposes that it is, it may none the less be the intellectual accompaniment of the machine process—of industrial rather than commercial civilization. There is nothing incompatible, so at least Veblen asserts, between a high commercialism and the densest animism—indeed, quite the contrary. A well-matured machine technique, however, presupposes and directly cultivates the scientific temper. The reconstruction of philosophy in modern times must be regarded as a refunding operation through which philosophy is being merged with modern science. This process began with the starry heavens above; Professor Dewey's latest book suggests the speculation that its consummation may be the moral law within.

Naturally the development of empiricism from Bacon and Hobbes to the present revolt against Hegelian absolutism has not been without incident: that wave of absolutism in the nineteenth century is its chief incident. The unsurpassed scientific objectivity of Hume and Kant was swamped in the decades that brought the Holy Alliance and the Wesleyan revival by a general resumption of the

medieval habit of mind. And through the exigencies of university organization this habit has persisted well into the twentieth century so that a world which has become thoroughly trained in the scientific bent can contemplate the persistence at the centers of its intellectual life of a tradition which, conceiving the human soul in the spirit of the medieval church, proceeds to impute its characteristics to the universe at large, to the utter neglect if not the denial of the contrary scientific preconceptions of all the rest of the world.

The presence and continued (though weakening) vigor of this tradition accounts for the posture of contemporary empiricism, as distinguished from that of the period which the course books call "modern." The modern philosophy of Bacon, or even of Descartes, represented the first onslaught of physics and mathematics upon the glorified animism of medieval theology—of the solar system upon the soular system. Contemporary instrumentalism, speaking in a world now overwhelmingly scientific, is directed against the last stand of animism (for McDougall is right in identifying mentalism as animism) in the field of human behavior. The most bitterly contested issues in contemporary philosophy (arising between idealism and pragmatism) are psychological issues. The first great breach in the tradition of absolutism was made by a psychologist trained in medicine and physiology; Professor Dewey's most distinctive achievement also is behaviorism. The *Essays in Experimental Logic*, so metaphysical in tone, have as their principal burden the maintenance of the psychological (behaviorist) assumption that thinking is a part of human behavior and must be treated as such against a school which rejoices first to abstract thinking from the rest of the universe and then to bring the universe over into thought. Similarly the educational principles of *Democracy and Education*, etc., derive from the behaviorist assumption on the nature of education: the behavior of children, intellectual and otherwise, can be guided successfully only in such an environment as provokes the desired responses and allows them to integrate into habits.

Perhaps it is owing to his absorption in educational theory that Professor Dewey's own interest in the study of behavior and the attack upon animism has become increasingly social and has now resulted in a volume of lectures on social psychology. Perhaps it is also due to his large preoccupation with public affairs during the war and the peace—since the time of Randolph Bourne's devoted though "savage indignation" that he was not then "out in the arena of the concrete, himself interpreting current life."[1] Probably a deeper reason lies in the character of social psychology.

[1] *New Republic*, March 13, 1915.

The vital issues of behaviorism are at this moment to be found in social psychology. The inevitable extension of the experimental technique from biology to psychology at first involved no abatement of mentalism. Certain mental states seemed to be susceptible to the technique, which was accordingly applied—particularly of course to sensations, since the sense organs are the most accessible. In the course of time the physiological character of both investigations and data has come to be recognized and a rapprochement established between neurology and psychology, until now so large a proportion of the actual labors of all the psychologists is experimental that the distinction between behaviorists and others seems largely a matter of terminology. Simultaneously, however, has come a quite general sense that mentalism, unwittingly pushed out of individual psychology by the experimental technique, can make a stand on instinct in social behavior. Particular reactions may be experimentally reducible to neurological (or glandular) terms; general tendencies may still be couched in terms as mystical as one could wish. The spirit world, excluded from the reflex arc, the tropism, and the hormone, may still make its entrance through the magic potencies of instinct, precisely as it once did through Descartes's pineal gland. The Cartesian dualism of mystical and scientific principles in human behavior is today the dualism of instinct and habit. To be sure, general interest in the problem has shifted from theology to sociology; but the issues remain unchanged.[2]

Upon this problem Professor Dewey now takes his stand as uncompromisingly as in his most polemical metaphysics. *Human Nature and Conduct* presents Dewey's theory of the organization of human behavior, in individuals and communities, by habit and custom. Its fundamental postulate is the abandonment of the old individual psychology of separate and independent minds by which mind has been conceived as a mysterious intruder, or a mysterious parallel accomplishment of the natural world (pp. 84, 5). The corresponding antithetical assumption that is postulated in its place is the one which has been much more familiar hitherto in anthropology than in psychology. There the formula is: *Omnis cultura ex cultura.* "The problem of social psychology," writes Dewey, "is not how either individual or collective mind forms social groups and customs, but how different customs, establishing interacting arrangements, form and nurture different minds" (p. 63). "We

[2] Professor Dewey emphasizes this shift of interest, attributing it to the general "decline in the authority of social oligarchy" (p. 3), and interest in "doing away with old institutions" (p. 93). Of course magic potencies may be displayed on both sides of such controversies. Carleton Parker drew on McDougall's instincts in his defense of the I. W. W., though McDougall reserves them for God, for country, and for home.

often fancy that institutions, social customs, collective habit, have been formed by the consolidation of individual habits. In the main this supposition is false to fact. . . . Customs persist because individuals form their personal habits under conditions set by prior customs'' (p. 58). That is, the indispensable condition of the organization of behavior is preëxisting organized behavior.

Such a theory of conduct has conspicuous implications for ethics. Professor Dewey accepts them at once, and accordingly makes moral conduct the chief subject of his analysis throughout the book. For such a theory of behavior as this, ''morals mean customs, folkways, established collective habits. This is a commonplace of the anthropologist, though the moral theorist generally suffers from an illusion that his own place and day is, or ought to be, an exception. But always and everywhere customs supply the standards for personal activities'' (p. 75). By accepting the hardly more than Darwinian hypothesis that the facts of man are continuous with those of the rest of nature we can ally ethics with physics and biology; by accepting the anthropological dogma of the continuity of all human activity we can link ethics with history, sociology, jurisprudence, and economics (p. 12). Even moral philosophy can be assimilated to modern science!

The three lectures, on habit, impulse, and intelligence, which make up the bulk of the book, seek to indicate how this may be done. They are an introduction not so much to the subject of social psychology, or of ethics, as to the problems: not a syllabus outline of a fully developed science but a preliminary statement of the presuppositions upon which a science may be developed. Habit is the framework and custom the content of behavior. Impulse is the propelling, energy-releasing force behind all activity—not in the form of the familiar instincts (there are no separate instincts), but as a tremendous multiplicity of exceedingly circumscribed reactions to specific stimuli.[3] They require to be organized by habit into modes of behavior and only thus assume form as the activity of civilized man. And if we do not know, at least we know how with our habits. Knowledge lives in the muscles, trained muscles, not in consciousness. Thought is the interruption, the clash, the readjustment of habits.

[3] Professor Dewey gives the reader every reason to suppose that the impulses which he retains as the basis of all behavior after the rejection of ''separate instincts'' are the reflexes and tropisms and so on, familiar to the neurologist. For some reason, to my mind highly questionable, he refrains from any direct assertion to this effect either in the form of a reference to the literature of neurology or by the use of identifying technical words. Perhaps neither could be done in lectures; but as an ''Introduction'' the book ought to introduce.

All this becomes concrete when it is applied to the problem of conduct. Morality is custom-organized, habitual behavior; there are no bad habits but custom makes them so. No moral order is based on instinctive, eternally unalterable behavior, nor can moral order result from the abrogation of all organizing conventions. Morality is the ordering of habit by intelligence. Rejecting all ethical principles that would identify morality with some special type of impulse or experience, Professor Dewey describes it essentially as Kant did—as order. "Intelligence is concerned with foreseeing the future so that action may have order and direction" (p. 238). Morality is the outcome of practical reason.

And then—strangely enough, for, from the *Outlines of Ethics* (published at Ann Arbor in 1891) to the present work, Dewey has devoted more space to the criticism of Kant than of any other philosopher, and always for this very peculiarity—he recommends intelligence!

This is no new thing, of course. "Creative intelligence" has been as much a slogan as a description among pragmatists since James. Professor Dewey's constant insistence in his philosophical writing upon the functional, experimental character of the thinking process seems to express a very deep-lying and in the end hyperlogical belief in its efficacy; while in the magazine articles his enthusiasm for intelligence approximates that of the revivalist.[4]

It is not my object here to give Kant an inning against his most insistent critic, nor even to assert the futility of advising the world to be intelligent, to organize its habits flexibly, and all that. Professor Dewey has made the best possible case against an ethics of mandatory principles in this book.[5] Simply to note that the categorical imperative appears from chapter to chapter is interesting, however.[6] In his famous essay on the influence of Darwin on philosophy Professor Dewey summarized as follows: "No one can

[4] *E.g.*, "The American Intellectual Frontier," *New Republic*, May 10, 1922.

[5] *E.g.*, p. 27. "Recently a friend remarked to me that there was one superstition current among even cultivated persons. They suppose that if one is told what to do, if the right *end* is pointed out to them, all that is required in order to bring about the right act is will or wish on the part of the one who is to act." *Etc., etc.*

[6] An individual "can, if he will, intelligently adapt customs to traditions" (p. 75). "The most precious part of plasticity consists in ability to form habits of independent judgment and of inventive initiation" (p. 97). "In learning habits it is possible for men to learn the habit of learning. Then betterment becomes a conscious principle of life" (p. 105). "The moral is to develop conscientiousness, ability to judge the significance of what we are doing. . . . Therefore the important thing is the fostering of those habits and impulses which lead to a broad, just, sympathetic survey of situations" (p. 207).

fairly deny that at present there are two effects of the Darwinian mode of thinking. On the one hand there are making many sincere and vital efforts to revise our traditional philosophic conceptions in accordance with its demands. On the other hand, there is as definitely a recrudescence of absolutist philosophies." Is it certain that the two will be wholly separate? Perhaps the gospel of science contains its own absolutism, its own rationalism, its own infinite,[7] its "appeal through experience to something that essentially goes beyond experience"—beyond, that is to say, the coolly skeptical experimental observations of the scientist.

Without doubt this is a lapse in logic. Yet for the discriminating reader it may serve to make the book a human document without materially affecting the clarity of the issues. Life is a continuous lapse of logic, and this book seems to me rather more alive, more directly and humanly expressive, than any other that Professor Dewey has yet written. This is yet another reason why, though it is an introduction, it is not a syllabus. One feels in reading that the whole range of interest of a most flexible mind is being played upon the text. The harmonies are rich and varied, and sonata-form gets lost in their depths. Indeed, the organization of the book is very loose—much less rigid even than the analytical table augurs. In general it follows the three-fold division indicated above; but apart from that the ideas flow down their natural and broken course rather than through the concreted channel of a pre-determined order.

The course provides many interesting moments. "All habits are demands for certain kinds of activity; and they constitute the self. In any intelligible sense of the word will, they *are* will" (p. 25). "For will means, in the concrete, habits; and habits incorporate an environment within themselves. They are adjustments *of* the environment, not merely *to* it" (p. 52). "Were it not for the continued operation of all habits in every act, no such thing as character could exist. There would be simply a bundle, an untied bundle at that, of isolated acts. Character is the interpenetration of habits" (p. 38). "Why have men become so attached to fixed, eternal ends? Why is it not universally recognized that an end is a device of intelligence in guiding action, instrumental to freeing and harmonizing troubled and divided tendencies? . . . Ends are, in fact, literally endless, forever coming into existence as new activities occasion new consequences" (pp. 231–2). "As we account

[7] "Religion, as a sense of the whole, is the most individualized of all things . . . . Instead of marking the freedom and peace of the individual as a member of an infinite whole, it has been . . . " (p. 331).

for war by pugnacity, for the capitalistic system by the necessity of an incentive of gain to stir ambition and effort, so we account for Greece by power of esthetic observation, Rome by administrative ability, the middle ages by interest in religion, and so on. We have constructed an elaborate political zoölogy as mythical and not nearly as poetic as the other zoölogy of phœnixes, griffins and unicorns'' (p. 111). ''Current democracy acclaims success more boisterously than do other social forms, and surrounds failure with a more reverberating train of echoes. But the prestige thus given excellence is largely adventitious. The achievement of thought attracts others not so much intrinsically as because of an eminence due to multitudinous advertising and a swarm of imitators'' (p. 66). ''It is only by accident that the separate and endowed 'thought' of professional thinkers leaks out into action and affects custom'' (pp. 68–9). ''. . . think of the insolent coercions, the insinuating briberies, the pedagogic solemnities by which the freshness of youth can be faded and its vivid curiosities dulled. Education becomes the art of taking advantage of the helplessness of the young; the forming of habits becomes a guarantee for the maintenance of hedges of custom'' (p. 64).

In short this is the most eminently readable and quotable book Professor Dewey has written.[8] But it is not a ''text''; it will not suit the orderly and sterile mind of the efficient teacher. And it will be a hard book for professional attackers and defenders of the pragmatic faith, for the word ''pragmatism'' occurs only in the index, the word ''instrumentalism'' not at all.

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Amherst College.

JOURNALS AND NEW BOOKS

Revista de Psiquiatria y Disciplinas Conexas (Lima). IV, 2. April, 1922. Los Mitos Médicos peruanos: *Hermilio Valdizán y Angel Maldonado.* Confusión mental en la encefalitis epidémica: *Max. Gonzales Olaechea.* El Mongolismo: *E. S. Guzmán Barrón.* Reacción subepidérmica a la adrenalina como método de exploración del sistema nervioso simpático: *Delfin C. Espino.* La negación de la paternidad como síntoma psicósico (conclusion): *Honorio F. Delgado.* Tratameinto de la epilepsia por el luminal: *Honorio F. Delgado.*

[8] This in spite of the lack of tonality of its author's style—frequently noted by reviewers—which allows him to use the jarring form ''morals is,'' and to pass over slips in construction like that on p. 22, line 16, or the ''one-them'' of a sentence quoted above.

REVUE PHILOSOPHIQUE. XLVII, 5–6. May–June, 1922. Le renouvellement des conceptions atomistiques: *L. Brunschvicg.* William James d'après sa correspondance: *J. Wahl.* L'ennui morbide: *L. Dupuis.* La psycholanalyse et le problème de l'inconscient, II: *A. Ombredane.*

University of Iowa Studies in Psychology: No. VIII. Edited by Carl E. Seashore. Psychological Monographs: Vol. No. 31, No. 1. Princeton. Psychological Review Co. 1922. 382 pp.

Nys, D.: La Notion d'espace. Bruxelles: Les Editions Robert Sand. 1922. Pp. 448. 30 fr.

Sainsbury, Geoffrey: Polarity. London: Favil Press. 1922. 48 pp. 3s 6d.

NOTES AND NEWS

A joint session of the Mind Association, the Aristotelian Society and the British Psychological Society was held in Manchester from July 14 to 18. Most of the papers read at that time will be published in the October issue of Mind.

Professor June E. Downey, head of the department of psychology at the University of Wyoming, has been granted leave of absence for travel and study during the academic year 1922–23. Miss Louisa C. Wagoner will be acting head of the department during Professor Downey's absence, and will be assisted by Mr. Donald A. Laird of the University of Iowa.

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Volume XIX. No. 12. June 8, 1922

Realism without Monism or Dualism—I. JOHN DEWEY.
The Differentiating Principle of Religion. H. C. ACKERMAN.
Intelligence and Intellect. A. A. ROBACK.
Book Reviews. Journals and New Books. Notes and News.

Volume XIX. No. 13. June 22, 1922

The New Materialism. JAMES BISSETT PRATT.
Realism Without Monism or Dualism—II. JOHN DEWEY.
Book Reviews. Journals and New Books. Notes and News.

Volume XIX. No. 14. July 6, 1922

The Dichotomy of Nature. W. H. SHELDON.
The Length of Human Infancy in Eighteenth Century Thought. ARTHUR O. LOVEJOY.
Book Reviews. Journals and New Books. Notes and News.

Volume XIX. No. 15. July 20, 1922

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A Metaphysician's Petitio. G. A. TAWNEY.
Book Reviews. Journals and New Books. Notes and News.

Volume XIX. No. 16. August 3, 1922

The Nature of Space—II. THEODORE DE LAGUNA.
Fiske Re-Anticipated. WILLIAM ERNEST HOCKING.
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Monthly. Founded 1904. Edited by Shepherd I. Franz.

Psychological Monographs—Princeton, N. J.; Psychological Review Company.
Subscription $5.50 per vol. 500 pp. Founded 1895. Ed. by James R. Angell.
Published without fixed dates, each issue one or more researches.

Psychological Index—Princeton, N. J.; Psychological Review Company.
Subscription $1.50. 200 pp. Founded 1895. Edited by Madison Bentley.
An annual bibliography of psychological literature.

Journal of Philosophy—New York; Sub-Station 84.
Subscription $4. 728 pages per volume. Founded 1904.
Bi-weekly. Edited by F. J. E. Woodbridge and Wendell T. Bush.

Archives of Psychology—Sub-Station 84, N. Y.; Archives of Psychology.
Subscription $5. 500 pp. ann. Founded 1906. Ed. by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology and Social Psychology—Boston;
Subscription $5. Richard G. Badger. Edited by Morton Prince.
Bi-monthly. 432 pages annually. Founded 1906. Abnormal and social.

Psychological Clinic—Philadelphia; Psychological Clinic Press.
Subscription $2.50. 288 pages. Ed. by Lightner Witmer. Founded 1907.
Without fixed dates (9 numbers). Orthogenics, psychology, hygiene.

Training School Bulletin—Vineland, N. J.; The Training School.
Subscription $1. 160 pages ann. Ed. by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Comparative Psychology Monographs—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages per volume. Edited by W. S. Hunter.
Published without fixed dates, each number a single research.

Psychoanalytic Review—Washington, D. C.; 3617 10th St., N. W.
Subscription $6. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Ed. by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.
Psychological Review Company. 480 pages annually. Experimental.
Subscription $4.25. Founded 1916. Bi-monthly. Ed. by John B. Watson

Journal of Applied Psychology—Worcester, Mass.; Florence Chandler.
Subscription $4. 400 pages annually. Founded 1917.
Quarterly. Edited by James P. Porter and William F. Beck.

Journal of Comparative Psychology—Baltimore: Williams and Wilkins Company
Subscription $5. 500 pages annually. Founded 1921.
Bi-monthly. Edited by Knight Dunlap and Robert M. Yerkes. J. P.